

Challenges of Continuing Safety Improvement



Christopher A. Hart
Chairman, NTSB

Outline

- NTSB Basics
- Challenges of Continuing Improvement
 - Complacency
 - Increasingly difficult to “Think out of the Box”

NTSB 101

- Independent federal agency, investigate transportation mishaps, all modes
- Determine probable cause(s) and make recommendations to prevent recurrences
- Primary product: Safety recommendations
 - Favorable response > 80%
- *SINGLE FOCUS IS SAFETY*
- Independence
 - Political: Findings and recommendations based upon evidence rather than politics
 - Functional: No “dog in the fight”



Complacency

- Less training generally for less frequent problems
- In deciding appropriate level of training for less frequent problems, important to consider severity of the problem
- Examples
 - Bedford, MA, 2014
 - Rio to Paris, 2009



Bedford

- Gulfstream G-IV
- Pilots almost always flew together in the same airplane
- Combined total time almost 30,000 hours, excellent training, unblemished record
- Before Starting Engines checklist: Disengage gust lock
- After Starting Engines checklist: Controls free and correct
- Pilots did not do “Controls free and correct” in 173 of previous 175 takeoffs
- Not deterred by yaw damper limiting light, inability to obtain target EPR, inability to rotate
- Waited too long to abort, overrun fatal to all 7 on board



Complacency Failures (by Pilots)

- Frequently did not follow checklist
- Did not challenge each other
- Disregarded several warning signs of serious problem



Example: Air France 447, Rio to Paris

– The Conditions

- Cruise, autopilot engaged
- Night, in clouds, turbulence, near thunderstorms, coffin corner
- Ice blocked pitot tubes, thus no airspeed information
- Autopilot and autothrottle became inoperative upon losing airspeed information
- Protections against aerodynamic stall disabled without airspeed information
- Pilots responded inappropriately, caused aerodynamic stall
- Crashed into the ocean, fatal to all 228 on board



– Queries:

- Pilot training re loss of airspeed information in cruise?
- Importance of CRM – pilot knowing other pilot's actions?
- Pilot training re manual flight at cruise altitude?



Complacency Failures (by System)

- Warning messages did not adequately convey cause and effect
- Transition from autopilot to manual flight immediate, no “grace period;” startle effect?
- No training re
 - Loss of airspeed information in cruise
 - Manual flight at cruise altitude
 - Avoidance of, recognition of, and recovery from aerodynamic stalls at high altitude
- Inadequate CRM training



Continuing Safety Improvement

- Safety improvements typically approach improvement limit asymptotically; then need additional improvement
- Previous major improvements (technology)
 - Jet engines
 - Simulators
- Most recent major improvement (process)
 - Collaboration through CAST
- Future improvements
 - No-fault compensation for crash victims?



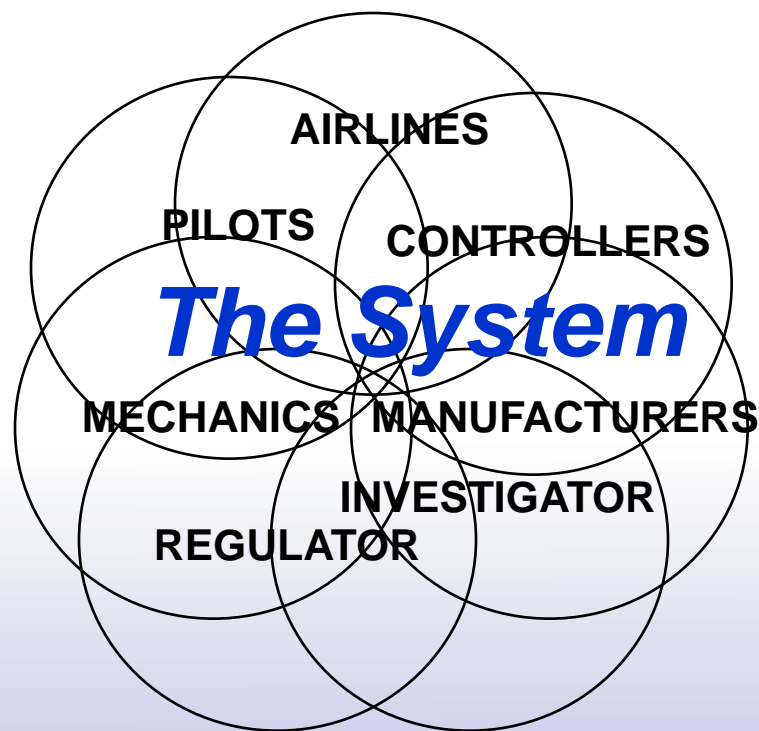
Catalyst for Process Improvement

- Fatal accident rate declining for decades, largely due to technological improvements
- Early 1990s, rate began to reach a plateau
- Volume projected to double in 15-20 years
- Stuck rate times doubling volume equals twice as many fatal accidents
- Public measures safety by number of events; low rate means little
- Industry sought new safety improvement methods to get off the plateau



The Context: Increasing Complexity

- More System *Interdependencies*
 - Large, complex, interactive system
 - Often tightly coupled
 - Hi-tech components
 - Continuous innovation
 - Ongoing evolution
- Safety Issues Are More Likely to Involve *Interactions Between Parts of the System*



Effects of Increasing Complexity

More “Human Error” Because

- System more likely to be error prone
- Operators more likely to encounter unanticipated situations
- Operators more likely to encounter situations in which “By the Book” may not be optimal (*“workarounds”*)



The Result

Front-line staff who are

- Highly trained
- Competent
- Experienced,
- Trying to do the right thing, and
- Proud of doing it well

. . . Yet they still commit

Inadvertent human errors



The Solution: System Think

*Understanding how a
change in one subsystem
of a complex system may
affect other subsystems
within that system*



System Think via Collaboration

Bringing all parts of a complex system together to collaboratively

- Identify potential issues
- *PRIORITIZE* the issues
- Develop solutions for the prioritized issues
- Evaluate whether the solutions are
 - Accomplishing the desired result, and
 - Not creating unintended consequences



Major Paradigm Shift

- Old: The regulator identifies a problem, develops solutions
 - Industry skeptical of regulator's understanding of the problem
 - Industry fights regulator's solution and/or implements it begrudgingly
- New: Collaborative “System Think”
 - Industry involved in identifying problem
 - Industry “buy-in” re interventions because everyone had input, everyone's interests considered
 - Prompt and willing implementation
 - Interventions evaluated . . . *and tweaked as needed*
 - Solutions probably more effective and efficient
 - Unintended consequences much less likely



Challenges of Collaboration

- Human nature: “I’m doing great . . . *the problem is everyone else*”
- Participants may have competing interests, e.g.,
 - Labor/management issues
 - May be potential co-defendants
- Regulator probably not welcome
- Not a democracy
 - Regulator must regulate
- Requires all to be willing, *in their enlightened self-interest*, to leave their “comfort zone” and think of the System



Success

- *83% decrease* in fatal accident rate, 1998 – 2007, largely because of *collaboration*
- Icing on the cake: The process also
 - Improved productivity,
 - Minimized unintended consequences; but
 - Created *no new regulations*

Note: Accident rate in the early 1990s was already considered very low, and many experts questioned whether it could be reduced further



Moral of the Story

Everyone who is involved in
the *problem* should be involved
in developing the *solution*



Future Improvement: Civil Litigation?

- Civil litigation has historically helped improve safety
- As systems become more complex and mishaps result from interactions between several persons, products, and organizations, query re continuing efficacy of civil litigation
 - “Punishes” rather than fixing
 - Extent of improvement, if any, often limited and delayed
 - Delayed and reduced compensation to victims
 - Challenging to allocate between several defendants



Suggested Alternative

- Victims Compensation Fund?
- No-fault recovery based largely upon formula?
- Contributions to Fund from all participants (analogous to insurance?)
 - Airlines
 - Manufacturers
 - Labor Unions
 - Regulator
- International accidents? Worldwide Fund?



Intent to Harm?

- In aviation accidents, action or inaction may be intentional, but intent to harm is very rare
- Who decides whether there was intent to harm?
- If intent to harm:
 - Additional “punitive” assessment?
 - Refer for criminal prosecution?
 - Both?
- If additional punitive assessment:
 - To victims, as additional compensation? If so, from Fund, or directly from perpetrator(s) of action intended to harm?
 - To Fund, from perpetrator(s) of action intended to harm?



Conclusions

- Exemplary safety record increases the need for vigilance against complacency
- Each safety improvement typically has an asymptotic limit; additional safety improvements are generally more challenging to create than previous improvements



Thank You

Questions?



National Transportation Safety Board